

REMARKS

Claims 1, 3-6 and 8-10 were examined and reported in the Office Action. Claims 1, 3-6 and 8-10 are rejected. Claims 1 and 6 are amended. Claims 1, 3-6, 8-10 remain.

Applicants request reconsideration of the application in view of the following remarks.

I. 35 U.S.C. § 112, First Paragraph

A. It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a semi-crystalline structure when boron (B) is present in the carbon shell, does not reasonably provide enablement for such a semi-crystalline structure for the other metal components. Applicant respectively traverses the aforementioned rejection for the following reasons.

Applicant asserts that an ordinary person skilled in the art would know that a semi-crystalline structure can be obtained using other metal components based on Applicant's description for a semi-crystalline structure with boron. Applicant describes that elements belonging to Group 3A or 4A of the Periodic Table, such as B, Al, Ga, Si, and Sn, or Group 8 such as Ni, Co, Fe, Mo, and Cr are substituted with one of six-membered carbons in graphite to twist its structure, therefore obtaining a semi-crystalline structure. Additionally, in case of the elements belonging to Group 1A and 2A such as Na, K, Mg, and Ca, the elements may be doped to graphite to expand its structure.

Therefore, Applicant's specification does enable an ordinary person skilled in the art.

Accordingly, withdrawal of the 35 U.S.C. §112, first paragraph rejection for claims 1, 3-6 and 8-10 are respectfully requested.

B. It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement due to the limitation "a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis." Applicant respectfully traverses the aforementioned rejection for the following reasons.

Applicant respectfully asserts that the assertion in the Office Action is incorrect because the semi-crystalline structure does not have both crystalline and amorphous forms. Rather the semi-crystalline structure has an intermediate structure that exists between crystalline and amorphous forms. This is supported by Applicant's FIG. 3 illustrating the exothermic peak of the active material according to Example 3. Applicant respectfully points out that in FIG. 3, no peak due to the amorphous carbon occurs at less than 700°C. Therefore, Applicant asserts that independent Claims 1 and 6, which have been amended to recite that the carbon shell has a semi-crystalline structure without a peak at less than 700°C are fully supported by Applicant's original specification.

Accordingly, withdrawal of the 35 U.S.C. §112, first paragraph rejection for claims 1, 3-6 and 8-10 are respectfully requested.

II. 35 U.S.C. § 112, Second Paragraph

A. It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant has amended claims 1 and 6 to overcome the 35 U.S.C. 112, second paragraph rejection.

Accordingly, withdrawal of the 35 U.S.C. §112, second paragraph rejection for claims 1, 3-6 and 8-10 are respectfully requested.

III. 35 U.S.C. § 103(a)

It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,027,833 issued to Ueda et

al. ("Ueda") in view of either U.S. Patent No. 5,595,838 issued to Yamada et al. ("Yamada") or U.S. Patent No. 6,337,159 issued to Peled et al. ("Peled"), and in further view of U.S. Patent No. 5,972,537 issued to Mao et al. ("Mao"). Applicants respectfully disagree.

According to MPEP 2142 "[t]o establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicants' disclosure." (In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)).

Applicants' amended claim 1 contains the limitations of "[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal."

Applicants' amended claim 6 contains the limitations of "[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including secondary particles, the secondary particle being prepared by agglomerating at least one primary particle of a crystalline carbon, an amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the

group of consisting of a transition metal, a semi-metal, an alkali metal and an alkali earth metal, and the metal is an elemental metal."

Ueda discloses a non-aqueous electrolyte secondary cell having a core made of crystalline graphite (carbon) structure. Ueda also discloses that a "low crystallinity or amorphous carbon layer 312 at least partially covering the core 311...." (Ueda, column 8, lines 9-13). The carbon shell disclosed in Ueda is not made of an elemental metal. Unlike the carbon shell of Applicant's claimed invention, the carbon shell disclosed in Ueda has a lower crystallinity, i.e. amorphous carbon.

Applicant encloses the previously submitted graph in a clearer presentation with each line labeled according to the Examiner's request. Applicant's submitted graph illustrates the differential thermal analysis result of Ueda. In the graph, MGC-0 indicates only amorphous carbon. MGC-10 indicates a 10 wt% of amorphous carbon shell on 90 wt% of a crystalline carbon core. From the attached graph and from Figure 3, the negative active material of Applicant's claimed invention is clearly distinguishable from Ueda. Moreover, Ueda does not disclose, teach or suggest a "the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal."

Yamada discloses a non-aqueous secondary battery arranged having "graphite-like planes [] arranged and stacked in an onion-like shell micro-texture ..." (Yamada, column 3, lines 44-49). Yamada further discloses that the carbon composite electrode includes a crystalline carbon core, a metal film coating the surface of the crystalline carbon core and a carbon layer deposited on the whole surface of the metal film. That is, Yamada discloses a triple layer. Applicant's claimed invention, however, includes a carbon core and shell with carbon having a semi-crystalline structure and a metal. That is, Applicant's claimed invention only includes a double layer structure. Yamada does not disclose, teach or suggest "[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline

carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.”

Peled discloses a non-aqueous electrochemical cell arranged having a synthetic passivating layer (SEI) being made of “ MACO_3 , M_2CO_3 , alkali semi-carbonates, MAO, M_2O , MAS, M_2S and alkali-and alkaline-earth metal salts of surface carboxylic groups (M=alkali metal, MA=alkaline earth metal). Distinguishable, Applicant’s claimed invention has a carbon shell in the form of an elemental metal whereas Peled discloses alkali semi-carbonates, alkali and alkaline earth metal salts, i.e. metal compounds. Applicant’s claims 1 and 6 contain the limitation “a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.” Peled, however, discloses the SEI (synthetic passivating layer) of is made of “ MACO_3 , M_2CO_3 , alkali semi-carbonates, MAO, M_2O , MAS, M_2S and alkali-and alkaline-earth metal salts of surface carboxylic groups (M=alkali metal, MA=alkaline earth metal)”. In addition, the SEI is formed by preferably bonding the SEI to the surface groups of the carbon particles after the surface groups are formed on the carbon particles.

Further, Peled does not disclose, teach or suggest a “[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.”

Mao discloses a method of fabricating a carbon material for use as an electrode in an electrochemical cell. Mao discloses that the "carbon materials are substantially amorphous [and they can also be] partially or completely crystalline or amorphous but possessing crystalline inclusions." (Mao, column 3, lines 6-10). Mao, however, does not teach, disclose or suggest that carbon has a semi-crystalline structure. Further, Mao does not teach, disclose or suggest "[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal."

Therefore, even if the teachings of Ueda, Yamada, Peled and Mao were combined, the resulting invention would still not teach, disclose or suggest "[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal" since neither Ueda, Yamada, Peled, Mao, nor the combination of the four, disclose, teach or suggest all of these limitations. Therefore, there would not be any motivation to arrive at Applicants' claimed invention. Thus, Applicants' amended claims 1 and 6 are not obvious over Ueda in view of either Yamada or Peled, and further in view of Mao since a *prima facie* case of obviousness has not been met under MPEP 2142. Additionally, the claims that directly or indirectly depend from Applicant's amended claims 1 and 6, namely claims 2, and 3-5, and 8-10, respectively, are also not

obvious over Ueda in view of either Yamada or Peled, and further in view of Mao for the above same reason.

Accordingly, withdrawal of the 35 U.S.C. § 103(a) rejections for claims 1, 3-6 and 8-10 are respectfully requested.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending, namely 1, 3-6, and 8-10, patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly extension of time fees.

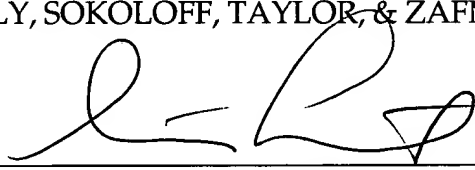
PETITION FOR EXTENSION OF TIME

Per 37 C.F.R. 1.136(a) and in connection with the Office Action mailed on September 21, 2004, Applicants respectfully petition Commissioner for a one (1) month extension of time, extending the period for response to January 21, 2005. The Commissioner is hereby authorized to charge payment to Deposit Account No. 02-2666 in the amount of \$120.00 to cover the petition filing fee for a 37 C.F.R. 1.17(a)(1) large entity. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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Dated: January 21, 2005

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail with sufficient postage in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P. O. Box 1450, Alexandria, Virginia 22313-1450 on January 21, 2005.


Jean Svoboda